United States
Department of
Agriculture

Forest Service

Forest
Products
Laboratory

DIVIDENDS FROM WOOD RESEARCH

Recent Publications

July-December 1986

instructions and explanation

"Dividends From Wood Research" is a semiannual listing of recent publications resulting from wood utilization research at the Forest Products Laboratory (FPL). These publications are produced to encourage and facilitate application of Forest Service research. This issue lists publications received from the printer by the FPL Publications Section between July 1, 1986, and December 31, 1986.

Each publication listed in this brochure is available through at least one of the sources below. For each entry in the brochure, we indicate the primary source for that publication and show you how to obtain a copy:

Available from FPL (indicated by an order number before the title of the publication): Quantities limited. Circle the order number on the blank at the end of the brochure and mail the blank to FPL.

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list of categories

Publications are listed in this brochure within the following general categories:

Anatomy and identification
Biodeterioration and protection
Chemicals from wood
Energy
Engineering properties and design criteria
Fire safety
General
Microbial and biochemical technology
Mycology
Processing of wood products
Pulp, paper, and packaging
Structural fiber and particle products
Timber requirements and economics
Tropical wood utilization
Wood bonding systems

anatomy and identification

1. A Response to Wheeler and Pearson's Critical Review of the IAWA Standard List of Characters

Miller, Regis B.
IAWA Bull. n.s. 7(3): 255-262; 1986.

The author responds to Wheeler and Pearson's (1985) critical review of the IAWA standard list of characters. He proposes that only a few minor changes in the standard list be considered. Essentially the list should remain the same until the changes can be discussed and the membership generally accepts them.

biodeterioration and protection

2. Approaches to the Improvement of Biological Resistance of Wood Through Controlled Release Technology

Chen, George C.; Rowell, Roger M.
In: Chaudry, Imtiaz; Thies, Curt, eds. Proceedings of the 13th International Symposium on Controlled Release of Bioactive Materials; 1986 August 3-6; Norfolk , VA. Lincolnshire, IL: The Controlled Release Society, Inc.; 1986: 75-76.

Conventional wood preservatives such as CCA, creosote, and pentachlorophenol are effective against decay fungi, marine borers, and insects, but are toxic to plants and mammals and cause environmental and health problems. Controlled release is a new technology by which to minimize the environmental and health hazards of treating wood with preservatives. Our current work in wood protection relating to controlled release technology is the investigation of bonding fungicides to wood through reactive functional groups and impregnating wood with polymers containing pendent fungicides.

3. Durability of Utility Poles in Panama

DeGroot, Rodney C.
USDA Forest Serv. Res. Pap. FPL-RP-478; 1986. 12 p.

Creosote-treated southern pine and Douglas-fir utility poles, produced in the United States and installed in Panama, were inspected for termites and for decay at the groundline. Findings indicate that current U.S. industrial and federal specifications for creosote treatment of southern pine poles provide adequate protection in most tropical environments, but some variation in performance was observed between poles set in different ecological biomes. In tropical regions, such as Panama, where termites pose a serious hazard, specifications for creosote treatment of Douglas-fir poles should be supplemented with requirements for treatment of soil around the pole with an approved termiticide.

4. Efficacy of Alternative Preservatives Used in Dip Treatments for Wood Boxes

DeGroot, Rodney C.; Stroukoff, Michael
USDA Forest Serv. Res. Pap. FPL-RP-481; 1986. 21 p.

Nailed pine boxes, wire-bound gum boxes, and wire-bound plywood boxes were dip treated with alternative wood preservatives and exposed above ground in a jungle and in an open field in Panama, and in a partially shaded field in southern Mississippi. This report describes results after 36 months' exposure at the two locations in Panama, and after 47 months' exposure in Mississippi. Results from the open field in Panama were intermediate between those from the jungle site and those from the site in Mississippi.

5. Utility Pole Decay. Part 4: Growth-Temperature Relations and Decay Capabilities of Eleven Major Utility Pole Decay Fungi

Eslyn, Wallace E.
Holzforschung. 40(2): 69-77; 1986.

The Basidiomycetes associated with decay in pine, Douglas-fir and western redcedar utility poles were previously elucidated. Such information is of limited usefulness, however, unless accompanied by knowledge of the role of these fungi in the pole decay process. The present study was initiated to determine the growth-temperature relations and the wood decay capabilities of a number of isolates of 11 of the more frequently encountered pole decay fungi. Temperature-growth rate studies were conducted on malt extract agar at various temperatures, utilizing from 5 to 10 isolates of each fungus studied. Decay testing was by the soil-block method, according to the American Society for Testing and Materials, using southern pine, Douglas-fir, and western redcedar blocks and from 5 to 20 isolates of each fungus studied.

6. Involvement of Hydrogen Peroxide in Wood Decay by Brown-Rot and White-Rot Fungi

Highley, Terry L.; Murmanis, Lidija L.
1985 May 12-17; Brazil. Document IRG/WP/1256. Stockholm, Sweden: IRG [International Research Group on Wood Preservation] Secretariat; 1985. 21 p.

To gain further understanding of the role of H_2O_2 in wood degradation by brown- and white-rot fungi, the authors studied: (a) extracellular H_2O_2 production, (b) effect of various hydroxyl radical (.OH) and singlet O_2 ($^1O_2$) quenching agents on wood and cellulose degradation, (c) intracellular H_2O_2 production and catalase activity, and (d) cytochemical localization of H_2O_2 with diaminobenzidine (DAB) during wood degradation.

Protective Finishes and Coatings for Wood

Feist, William C.
In: Bever, Michael B., ed. Encyclopedia of Materials Science and Engineering; vol. 8. Elmsford, NY: Pergamon Press Inc.; 1986: 3981-3982. (Available through libraries.)

The author discusses the various film-forming finishes such as paints, varnishes, and lacquers. Also discussed are the penetrating finishes, i.e., water repellents, stains, and preservatives.

7. Comparison of Wood Preservatives in Stake Tests (1985 Progress Report)

Gjovik, L. R.; Gutzmer, D. I.
USDA Forest Serv. Res. Note FPL-02; 1986. 100 p.

This report covers test stake results primarily from southern pine sapwood 2 by 4 by 18 inches in size, treated by pressure and nonpressure processes, and installed by the Forest Products Laboratory and cooperators in our decay and termite exposure sites at various times since 1938 at Saucier, MS, Madison, WI, Bogalusa, LA, Lake Charles, LA, Jacksonville, FL, and the Canal Zone, Panama. Also included in the tests at Saucier, MS, are smaller pine stakes and those of treated and untreated plywood, particleboard, modified woods, laminated paper plastic, pine infected with Trichoderma mold, plus other selected wood species such as oak, Douglas-fir, and Engelmann spruce.

8. Long-Term Effectiveness of Fumigants in Controlling Decay in Douglas Fir Waterfront Timbers

Highley, Terry L.
1986 May 25-30; Avignon, France. Document No. IRG/WP/3364. Stockholm, Sweden: IRG [International Research Group on Wood Preservation] Secretariat; 1986. 7 p.

The persistence, movement, and effectiveness of chloropicrin and Vapam (sodium N-methyl dithiocarbamate) in large, horizontal Douglas-fir timbers were evaluated 7 years after fumigation. Chloropicrin prevented reestablishment of decay fungi; reinvasion occurred in some Vapam-treated timbers. Residual fungistatic effect was detected up to 1.2 m from the fumigation site in chloropicrin-treated timbers but not in Vapam-treated timbers.

9. Efficacy of Fumigants in the Eradication of Decay Fungi Implanted in Southern Pine Timbers

Highley, Terry L.; Eslyn, Wallace E.
1986 May 25-30; Avignon, France. Document No. IRG/WP/3365. Stockholm, Sweden: IRG [International Research Group on Wood Preservation] Secretariat; 1986. 12 p.

Southern pine timbers (15.2 cm x 15.2 cm x 4.26 m) were fumigated at midlength to evaluate the effectiveness of eight fumigants in eradication of decay fungi. The fumigants were introduced into 2.54-cm holes which were closed immediately with rubber stoppers. Movement and persistence of lethal concentrations of the vapors were monitored using eight important wood-decay fungi as the vapor-sensing agents. Residual fumigant in the timbers was determined by a bioassay with *Gloeophyllum trabeum*.

10. Weathering Characteristics of Hardwood Surfaces

Hon, D.N.-S.; Feist, W. C.
Wood Sci. Technol. 20(2): 169-183; 1986.

Four hardwoods—red oak, white oak, yellow-poplar, and sweetgum—were exposed to outdoor weathering and to artificial ultraviolet (UV) light with wavelengths of $\lambda > 220$ and > 254 nm. Discoloration and loss of brightness were observed from all specimens regardless of their exposure conditions. White oak and sweetgum changed color at a slower rate than did red oak and yellow-poplar. SEM micrographs showed that all wood species exhibited surface deterioration after 30 days exposure to sunlight or 500 hours to UV light.

11. Extending the Life of Beehives With and Without Preservatives

Kalnins, Martins A.; Erickson, Eric H.
Am. Bee J. 126(7): 488-491; 1986.

The useful life of beehives may be extended by taking care to prevent decay and insect attack. Several wood preservatives (copper naphthenate, copper-8-quinolinolate, and acid copper (chromate) are reported to be harmless to bees or hive products. Others (creosote, chromated copper arsenate (CCA), tributyl tin oxide (TBTO), and pentachlorophenol) are reported to contaminate hive products or harm the bees. Preservatives may be applied by brush, dip treatment, hot and cold baths, and commercial pressure-treating processes.

12. Technology of Preserving Wood Structures

Sherwood, Gerald E.
In: Davis, G., ed. Building performance: Function, preservation, and rehabilitation; 1983 October 17; Bal Harbour, FL. Philadelphia: American Society for Testing and Materials; 1986: 121-135.

This paper presents research results applicable to extending the service life of wood structures. It includes information on fundamental properties of wood and on factors that influence serviceability, such as loading, temperature, moisture, chemicals, and weathering. The author summarizes state-of-the-art methods and practices for extending the life of wood structures and includes an extensive list of references. This overview of technology for preservation and rehabilitation of wood structures should be useful to designers, builders, and regulatory bodies involved in building preservation and rehabilitation.

13. Effects of Acid Rain on Painted Wood Surfaces: Importance of the Substrate

Williams, R. Sam
In: Baboian, Robert, ed. Materials degradation caused by acid rain: ACS symposium series 318; 1985 June 17-19; Arlington, VA. Washington, DC: American Chemical Society; 1986: 310-331.

The effects of acid rain on painted materials can be seen in at least two phenomena, degradation of the coating and degradation of the substrate. Most research on acid degradation and painted materials has focused on degradation of coatings caused by gaseous pollutants such as sulfur dioxide and nitrogen dioxide—known precursors of acid rain. This work showed that the type of pigment and extenders used in the paint formulation had a direct bearing on paint performance in an acid environment. The degradation of the substrate also has a direct bearing on coating performance.

chemicals from wood

14. Kinetic Modeling of the Saccharification of Prehydrolyzed Southern Red Oak

Conner, Anthony H.; Wood, Barry F.; Hill, Charles G, Jr.; Harris, John F.
In: Young, Raymond A.; Rowell, Roger M., eds. Cellulose Structure, Modification and Hydrolysis. New York: John Wiley & Sons; 1986: 281-296.

In this chapter the authors describe a new model for the dilute acid hydrolysis of cellulose that was developed at FPL in connection with our studies on the two-stage dilute sulfuric acid hydrolysis process. The model incorporates the effect of the neutralizing capacity of the substrate, the presence of readily hydrolyzable cellulose, and the reversion reactions of glucose in acid solution. Although general in nature, the model was developed specifically for application to the dilute sulfuric acid hydrolysis of prehydrolyzed wood. A computer program to simulate the new model under various hydrolysis conditions is presented. This program can be used to predict yields of free glucose, reducing sugars, reversion material, remaining cellulose, and glucose loss due to dehydration as a function of acid concentration, temperature, and reaction time.

15. The Structure of an Abietic Acid Dimer

Gigante, Barbera; Jones, Ray; Lobo, Ana M.; Marcelo-Curto, M. Joao; Prabhakar, Sundaresan; Rzepa, Henry S.; Williams, David J.; Zinkel, Duane F.
J. Chem. Soc., Chem. Commun. 13: 1038-1039; 1986.

The first X-ray structural determination of an acid-catalysed dimer of abietic acid is reported.

16. Proton NMR of Pimaric and Isopimaric Acids: Apparent Anomalies in Spectral Patterns of the C-15 Vinyl Hydrogen

Landucci, Lawrence L.; Zinkel, Duane F.
Naval Stores Review. 96(5): 18-20; 1986.

The NMR spectra of various methyl pimarates and isopimarates appear to have field-dependent anomalies in the spectral patterns associated with the exocyclic vinyl protons. Some of these compounds exhibit six lines for the X portion of the ABX pattern at low field strengths, whereas most exhibit four lines at both low and high field strengths. One of the compounds exhibits six lines at both low and high field strengths. These apparent anomalies are caused by a transition between first- and second-order patterns which is dependent on field strengths.

17. A Rapid Method for Diterpene Resin Acid Analysis of Pine Needle Oleoresin

Magee, Thomas V.; Zinkel, Duane F.
Can. J. Forest Res. 16(5): 1107-1109; 1986.

Analysis of pine needle oleoresin for diterpene resin acid composition has been studied with respect to chemotaxonomic and genetic applications. The analysis requires separation of the neutral from the acidic components, for which a quantitative separation method using DEAE-Sephadex has already been developed. However, because of the sample size generally used in this method (100-150 mg acids), the time needed for the separation alone is the major constraint in the overall resin acid analysis.

Chemical Modeling in the Deduction of Process Concepts: A Proposed Novel Process for Lignin Liquefaction

McDermott, John B.; Klein, Michael T.; Obst, John R.
Ind. Eng. Chem. Process Des. Dev. 25(4): 885-889; 1986. (Available from Dr. Michael T. Klein, University of Delaware, Department of Chemical Engineering, Newark, DE 19716. No charge.)

The topic of hydrogen consumption during lignin liquefaction is used as a vehicle with which to illustrate the application of chemical modeling in the deduction of conceptual process flow sheets. Chemical modeling is the use of model compound information, such as reaction pathways, kinetics, and mechanisms, in the analysis of real reaction systems. Experiments with the model compound a-[(o-methoxyphenoxy)methyl]veratryl alcohol, a structural mimic of prevalent b-ether moieties within lignin, allowed resolution of a major dehydration reaction and a minor fragmentation reaction as the primary pathway of its thermolysis. The general usefulness of chemical modeling is emphasized over the details of the specific vehicle strategy.

18. Chemical Linkage of Polysaccharides to Residual Lignin in Loblolly Pine Kraft Pulps

Minor, J. L.
J. Wood Chem. Technol. 6(2): 185-201; 1986.

The chemical bonding of polysaccharides to the residual lignin remaining in bleachable grade loblolly pine (*Pinus taeda*) kraft pulp was examined by methylation analysis. Before analysis, most of the nonbonded polysaccharides were enzymatically hydrolyzed and the sugars were washed from the remaining solid to give a residual lignin that contained about 8 percent carbohydrates. The analysis indicated that the majority of the remaining sugars were present as oligomeric segments of well-characterized pulp polysaccharides. About one monomeric unit per oligomer was bonded to lignin.

19. The Syringyl Content of Softwood Lignin

Obst, John R.; Landucci, Lawrence L.
J. Wood Chem. Technol. 6(3): 311-327; 1986.

The goal of the present work was to obtain a realistic value of the syringyl content of typical softwood lignin by refining the method of C-13 NMR spectroscopy and pyrolysis-gas chromatography. The authors also examined a chemical method, alkaline nitrobenzene oxidation, which is not likely to create syringyl artifacts.

Laboratory Evaluation of Sodium N-Methyldithiocarbamate for Preserving Tall Oil and Turpentine in Stored Pine Chips

Springer, E. L.; Zinkel, D. F.
USDA Forest Serv., Forest Products Lab., Madison, WI; 1986 April. 12 p. (Available from National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161; $9.95; PB86-224417/AS.)

Fresh slash pine chips were treated by immersion in a solution of sodium N-methyldithiocarbamate and stored under aerobic conditions, in 4-cubic-foot insulated boxes. The treatment level of 0.8 pound of chemical per ovendry ton of wood resulted in complete preservation of turpentine and a significant portion of the tall oil precursors in the chips during 40 days of storage but only when chips were treated immediately after chipping the wood. Comparisons of tall oil availability were based on diethyl ether extraction of chips because the measurement of tall oil in the circulating black liquor after kraft pulping of the chips was shown to be unreliable.

The Effect of Precipitation on the Molecular Weight Distribution of Cellulose Tricarbanilate

Wood, Barry F.; Conner, Anthony H.; Hill, Charles G., Jr.
J. Appl. Polym. Sci. 32: 3703-3712; 1986. (Available from Information Services Division, Kurt F. Wendt Library, College of Engineering, University of Wisconsin-Madison, 215 North Randall Avenue, Madison, WI 53706; $5.)

The effect of precipitation on the molecular weight distributions of cellulose tricarbanilate (CTC) samples prepared from a-pulp, hydrolyzed a-pulp, and Avicel was determined using size exclusion chromatography (SEC). SEC analysis of the nonvolatile products from the carbanilation reaction offers a simple method for determining the complete molecular weight distribution of this cellulose derivative.

20. Identification of New Resin Acids in Southern Pine Oleoresins and Rosin

Zinkel, Duane F.
Naval Stores Review. 96(3): 18-19; 1986.

Five labdane resin acids were identified for the first time as components of slash and longleaf pine xylem oleoresins. One of these components, acetylisocupressic acid, comprised as much as 6 percent of the total resin acids. These labdane acids appear to be little affected by processing the oleoresin into rosin.

Gas Chromatography of Resin Acids with a BDS (Butanediol Succinate) Fused Silica Capillary Column

Zinkel, D. F.; Han, J. S.
USDA Forest Serv., Forest Products Lab., Madison, WI; 1986 April. 12 p. (Available from National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161; $9.95; PB86-223864/AS.)

The resin acid composition of rosins and oleoresins can be determined by gas chromatography using a 7-meter BDS fused silica column. Operating conditions can be optimized by considering temperature-dependent separation factors, liquid phase stability, and analysis time in relation to quantitation and component identification by retention characteristics.

energy

21. Alcohol from Wood as an Alternative Transportation Fuel

Zerbe, John I.
In: Alternative Energy in the Midwest: Research and Applications; Conference Proceedings, vol. 1; 1985 February 21-23; Schaumburg, IL. [Springfield, IL]: Illinois Department of Energy and Natural Resources; 1986: 3-3 - 3-7.

The author discusses the various fuel alcohols, such as ethanol and methanol, that can be made from wood.

engineering properties and design criteria

Wood as a Building Material

Freas, A. D.
In: Bever, Michael B., ed. Encyclopedia of Materials Science and Engineering; vol. 8. Elmsford, NY: Pergamon Press Inc.; 1986: 5385-5390. (Available through libraries.)

The author discusses the important characteristics of wood such as durability, behavior in fire, load applications, dimensional stability, resistance to chemicals, and strength and structural design. Also discussed is the wide range of wood applications.

Characterizing the Properties of 2-Inch Softwood Dimension Lumber with Regressions and Probability Distributions: Project Completion Report

Galligan, William L.; Hoyle, Robert J.; Pellerin, Roy F.; Haskell, James H.; Taylor, James R.
USDA Forest Serv., Forest Products Lab., Madison, WI; 1986. 135 p. (Available from National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161; $16.95; PB86-224227/AS.)

Mechanical property data based on tests of full-sized structural lumber and suitable for statistical characterization were sought through personal contact with wood research institutes and through literature search. Suitable data were meager. Supplemental data were obtained through tests of Southern Pine and Hem-Fir. Data were fit by simple linear regressions of strength on modulus of elasticity (E). Different methods of E measurement were contrasted. Distributions (Weibull, lognormal, and normal) were fitted to E and tensile, compressive, and bending strength. Regression slopes appeared different for the three strength properties. The Weibull distribution was the most common choice; however, differences often were small.

Electrical Properties of Wood

James, W. L.
In: Bever, Michael B., ed. Encyclopedia of Materials Science and Engineering; vol. 8. Elmsford, NY: Pergamon Press Inc.; 1986: 1395-1399. (Available through libraries.)

The electrical properties of wood are complex because of its complex, hygroscopic structure. Wood consists of small crystal-like regions dispersed in a matrix of amorphous material. The amorphous material is hygroscopic, so wood contains moisture in proportion to the humidity of its environment. The moisture content of wood affects its electrical properties much more than any other factor. The electrical properties considered here are conductivity, dielectric constant, loss tangent, dielectric strength and piezoelectric behavior.

22. Flat-Crush Failure Mechanism of Corrugated Fiberboard

Liu, Jen Y.
J. Appl. Mech., Trans. ASME. 53: 602-608; 1986.

This paper analyzes the behavior of corrugated fiberboard under flatcrush loading using the elastica theory. The analysis is useful for evaluating the quality of the board as well as for studying its damping characteristics. The linerboard facings are considered as rigid plates, compressing the fluted corrugating medium between them. The flute is composed of linear and circular elements. The procedure used reduced geometry to account for the flattening of the flute in conformation with the linerboards during compression.

23. Stiffness of Framing Members with Partial Composite Action

McCutcheon, William J.
J. Struct. Eng. 112(7): 1623-1637; 1986.

A simple procedure is presented for computing the composite stiffness of a wood bending member with sheathing attached nonrigidly to one or both edges. To account for interlayer slip, it is only necessary to modify the axial stiffnesses of the flanges and then compute the stiffness of the resulting T-beam or I-beam by the "transformed area" procedure. Test data agreed very closely with theoretical predictions. The method also provides reasonable estimates of interlayer slip. The procedure can be carried out on a hand-held calculator and is therefore in a form which can be accepted by code writers and easily implemented by designers.

24. Measuring Localized Slope of Grain by Electrical Capacitance

McDonald, Kent A.; Bendtsen, B. Alan
Forest Prod. J. 36(10): 75-78; 1986.

Electrical capacitance was found to be effective for measuring localized slope of grain in lumber. When slope-of-grain measurements were taken incrementally every 1/4 inch along and across the faces of several 2 by 4 samples, accurate grain patterns around knots were graphically reproduced. The technique exhibits considerable promise as a means for providing localized slope-of-grain information to grain flow analysis models being designed to predict lumber strength.

25. Tension, Compression, and Shear Properties of Waferboard from Small-Specimen Tests

McNatt, J. Dobbin
Forest Prod. J. 36(10): 60-62; 1986.

Tension, compression, and shear properties of three waferboards and one additional phenolic-bonded flakeboard, all commercial products, were determined by test methods in ASTM Standards D 1037 and D 3044. Tensile strengths parallel to the surface and edgewise shear strengths were nearly equal for all four materials. The compressive strength of waferboard was 12 to 30 percent greater than its tensile strength. Flakeboard compressive strength was 2.3 times the tensile strength.

26. Strength and Stiffness Reduction of Large Notched Beams

Murphy, Joseph F.
J. Struct. Eng. 112(9): 1989-2000; 1986.

Four large glulam beams with notches on the tension side were tested for strength and stiffness. Using either bending net section beam theory or shear formula to calculate crack propagation critical load is very unconservative. A linear elastic fracture mechanics approach, taking into account the high tension stresses perpendicular to grain and shear stresses at the notch reentrant corner, conservatively predicts the critical load. The data corroborate the substantial analytic effect of size predicted by fracture mechanics for notched beams. Results quantify the observed behavior of bending of beams with notches on the tension side. The strength reduction is so severe for large beams that substituting a beam having the net depth of the notched beam is preferable.

27. Bearing Strength of Bolted Timber Joints

Soltis, Lawrence A.; Hubbard, Finn K.; Wilkinson, Thomas L.
J. Struct. Eng. 112(9): 2141-2154; 1986.

Design values for bolted timber joints are empirically based on research conducted more than 50 years ago. The analytical and experimental results of this study confirm that the previous recommendations are still valid. The analytical method used in this study, the European yield theory, explains much of the observed behavior of bolted timber joints and can be used for material properties not included in the original research. It also incorporates the effect of bolt yield stress, which is not considered in current design.

28. Moisture Movement in Walls in a Warm Humid Climate

TenWolde, A.; Mei, H. T.
In: Thermal performance of the exterior envelopes of building III: Proceedings of Conference; 1985 December 2-5; Clearwater Beach, FL. Atlanta, GA: American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.; 1986: 570-582.

Most research on condensation of moisture in exterior wood-frame walls has focused on moisture problems in walls in cold winter climates even though air-conditioned buildings in warm, humid climates also have potential for moisture damage. To investigate moisture movement in walls in a warm, humid climate, a test building was erected on the campus of Lamar University, Beaumont, TX. This building holds nine instrumented wall panels of different construction and are all installed on the south side of the building. A cooperative field-exposure study was conducted at this site by the Forest Products Laboratory and Lamar University.

29. Static Behavior of Wood-Joist Floors at Various Limit States

Wheat, Dan L.; Gromala, David S.; Moody, Russell C.
J. Struct. Eng. 112(7): 1677-1691; 1986.

This paper presents the results from a study of wood-joist floors undertaken at the Ferguson Structural Engineering Laboratory of the University of Texas at Austin. The goal of this research was to describe the behavior of wood-joist floors, in both quantitative and qualitative terms, as they are loaded to their ultimate capacities. It is hoped that some insight will be gained about the behavior of these structures as they reach various serviceability and strength limit states such as design load, first joist rupture, and the loss of the ability to support a uniform load.

Wood Joints with Mechanical Fastenings

Wilkinson, T. L.
In: Bever, Michael B., ed. Encyclopedia of Materials Science and Engineering; vol. 6. Elmsford, NY: Pergamon Press Inc.; 1986: 5438-5440. (Available through libraries.)

The strength and stability of any structure depend heavily on the fastenings that hold its parts together. A prime advantage of wood as a structural material is the ease with which wood structural parts can be joined together with a wide variety of fastenings. For utmost rigidity, strength and service, each type of fastening requires careful design. This article is concerned with standard mechanical fasteners and some of the factors that need consideration in the design of joints using them.

30. Design of Wood Members Under Combined Load

Zahn, John J.
J. Struct. Eng. 112(9): 2109-2126; 1986.

A new design criterion for wood members under combined axial and bending loads is proposed. The new equation covers biaxial bending, axial load, and water ponding. It employs Ylinen's column formula for beam or column buckling, and replaces the linear interaction equation with more accurate equations based on recent test data and results of elastic stability analysis. Despite its simplicity, the proposed criterion is more general, more rational and more accurate than the existing design criterion.

fire safety

31. Preliminary Investigation of Fire-Retardant Treatments for Flakeboards

Laufenberg, Theodore; LeVan, Susan; Bruci, Vladimir
Drvna Ind. 36(3-4): 65-70; 1986.

This paper details the results of preliminary investigations of three promising fire-retarding chemicals for flakeboards: aluminum (III)-oxide-trihydrate (ATH), boric acid-disodium octoborate (BADO), and melamine-dicyandiamide formaldehyde phosphoric acid (MDP). Oxygen Index tests were used to assess the relative efficiency of the fire-retardants when various application methods and loading levels were used. Internal bond tests were used to evaluate the flakeboards' relative bond strength. Results indicate the BADO and MDP systems provide significantly improved fire-retardancy, though bond strength is reduced with the BADO.

general

32. Directory of Research Programs

Forest Products Laboratory
USDA Forest Serv., Forest Products Lab.; 1987. 4 p.

This directory provides a breakdown of research programs at the Forest Products Laboratory (FPL) from general areas of research emphasis to specific research work units (RWUs). The general areas are Wood Products Research (6 RWUs), Chemistry and Paper Research (5 RWUs), and Process & Protection Research (6 RWUs). Other programs include the Institute of Microbial & Biochemical Technology, the Tropical Forestry Program, and Energy From Wood. Scientists in charge, the Laboratory Director's Staff, and key Administration and Research personnel are also listed.

Timbers of Canada and the USA

Maeglin, Robert R.
In: Bever, Michael B., ed. Encyclopedia of Materials Science and Engineering; vol. 8. Elmsford, NY: Pergamon Press Inc.; 1986: 5020-5025. (Available through libraries.)

The Canadian and U.S. hardwood and softwood forests provide rich reserves of timber. The species and characteristics of the timber are molded by diverse climatic, topographic and edaphic conditions into a variety of raw materials for many products and uses. This article considers 35 of the most important Canadian and U.S. species or species groups, comparing their properties and uses. Other species are mentioned without detail.

33. Forest Products Research Conference 1986: Matching Utilization Research with the Needs of Timber Managers

Forest Products Laboratory
USDA Forest Serv., Forest Products Lab.; 1987. 105 p.

This publication contains presentations and discussion reports from the October 21-23, 1986, Forest Products Research Conference held at the Forest Products Laboratory, Madison, WI. Several sections address the need for matching wood research with the needs of timber managers and owners.

microbial and biochemical technology

34. Role of Veratryl Alcohol in Regulating Ligninase Activity in *Phanerochaete chrysosporium*

Faison, Brendlyn D.; Kirk, T. Kent; Farrell, Roberta L.
Appl. Environ. Microbiol. 52(2): 251-254; 1986.

The authors considered two possible mechanisms whereby veratryl alcohol causes an increase in enzyme activity measured in vivo. First, a protective effect may stabilize the enzyme against inactivation or proteolytic decay. These compounds would thus counteract the rapid decline in ligninase activity observed in aging cultures. Such a protective effect would be independent of protein synthesis. Second, a true increase in ligninase activity may be caused by an effect on the amount or type of ligninase(s) produced. This mechanism would require de novo protein synthesis.

35. Substrate Free Radicals are Intermediates in Ligninase Catalysis

Hammel, Kenneth E.; Kalyanaraman, B.; Kirk, T. Kent
Proceedings National Academy of Science USA. 83: 3708-3712; 1986.

The H_2O_2-requiring ligninase of the basidiomycete *Phanerochaete chrysosporium* oxidatively cleaves both lignin and lignin model compounds between C_α and C_β (C-1 and C-2) of their aliphatic side chains. Previous work has demonstrated a reaction mechanism by which ligninase oxidizes aromatic substrates to their cation radicals, which then undergo side chain cleavage to yield carbon-centered free radicals. These carbon-centered radicals add O_2 to give substrate peroxyl radicals that react further to yield the hydroxylated and carbonylated end products usually seen in experiments with ligninase. To investigate this radical mechanism, we have now designed three dimeric lignin models: 1-(3,4-dimethoxyphenyl)-2-phenylethanol (I),1-(3,4-dimethoxyphenyl)-2-phenylpropanol (II), and 1-(3,4-dimethoxyphenyl)-2-methyl-2-phenylpropanol (III).

36. Ligninase of *Phanerochaete chrysosporium*: Mechanism of its Degradation of the Non-Phenolic Arylglycerol β-aryl Ether Substructure of Lignin

Kirk, T. Kent; Tien, Ming; Kersten, Philip J.; Mozuch, Michael D.; Kalyanaraman, B.
Biochem. J. 236: 279-287; 1986.

This study examined the ligninase-catalysed degradation of lignin model compounds representing the arylglycerol β-aryl ether substructure, which is the dominant one in the lignin polymer. Three dimeric model compounds were used, all methoxylated in the 3- and 4-positions of the arylglycerol ring (ring A) and having various substituents in the β-ether-linked aromatic ring (ring B), so that competing reactions involving both rings could be compared.

37. Levels of Enzymes of the Pentose Phosphate Pathway in *Pachysolen tannophilus* Y-2460 and Selected Mutants

Lachke, Anil H.; Jeffries, Thomas W.
Enzyme Microb. Technol. 8: 353-360; 1986.

The compositions of intracellular pentose phosphate pathway enzymes have been examined in mutants of *Pachysolen tannophilus* NRRL Y-2460 which possessed enhanced D-xylose fermentation rates. The levels of oxidoreductive enzymes involved in converting D-xylose to D-xylulose via xylitol were 1.5-14.7-fold higher in mutants than in the parent. These enzymes were still under inductive control by D-xylose in the mutants. The best ethanol-producing mutant showed the highest ratio of NADH- to NADPH-linked D-xylose reductase activity and high levels of all other pentose phosphate pathway enzymes assayed.

38. The Ligninolytic Activities of Lentinus edodes and *Phanerochaete chrysosporium*

Leatham, Gary F.
Appl. Microbiol. Biotechnol. 24: 51-58; 1986.

Two important lignin-degrading fungi with existing or potential applications in the production of food, feed and/or fiber products from wood are *Lentinus edodes* (Berk.; Sing. = *Lentinus edodes* [Pegler]) and *Phanerochaete chrysosporium* (Burds). This study discusses their relative ability to degrade lignin and the factors controlling their ligninolytic activity (synthetic ^{14}C-lignin $\rightarrow$ $^{14}CO_2$).

39. Ethanol Production from D-xylose in Batch Fermentations with *Candida shehatae:* Process Variables

Sreenath, Hassan K.; Chapman, Thomas W.; Jeffries, Thomas W.
Appl. Microbiol. Biotechnol. 24: 294-299; 1986.

These studies examined several process variables important in scaling up the fermentation of xylose by *Candida shehatae*. Inoculum age and cell density were particularly influential.

mycology

40. *Platygloea acanthophysa,* a New Species with Single Sterigmate Basidia and Acanthophyses

Burdsall, Harold H., Jr.
Mycotaxon. 27: 499-502; 1986.

The genus *Platygloea* Schroter in the Heterobasidiomycetidae is distinguished by a well-developed probasidium that produces a cylindrical, transversely septate metabasidium. The basidiospores germinate by repetition. However, several species of *Platygloea* form only an aseptate metabasidium or a metabasidium with a single septum. The new species of *Platygloea* described here with an aseptate metabasidium producing a single sterigma was collected in northern Wisconsin in 1973. Further collecting in similar habitats has not provided additional specimens of this species.

41. *Hebeloma arenosa* (Agaricales, Cortinariaceae), a New Species from Lake States Nurseries

Burdsall, H. H., Jr.; MacFall, J. S.; Albers, M. A.
Mycologia. 78(5): 861-865; 1986.

A new species of *Hebeloma* is described and illustrated. Cultural characteristics are also reported.

42. New Combinations in the Genus *Postia* Fr. (Polyporaceae)

Larsen, Michael J.; Lombard, Frances F.
Mycotaxon. 26: 271-273; 1986.

The genus *Postia* (Polyporaceae) is regarded as the appropriate taxonomic unit for brown-rot fungi with a monomitic hyphal system. Its species have been previously described or included in *Polyporus, Poria, Fibroporia, Tyromyces, Leptoporus, Oligoporus, Ceriporiopsis,* and *Amylocystis*. Eight new combinations are proposed in *Postia*.

processing of wood products

43. High-Temperature Kiln-Drying Red Maple Lumber—Some Options

Boone, R. Sidney
Forest Prod. J. 36(9): 19-25; 1986.

The objective of this study was to determine the drying degrade in 4/4 red maple (*Acer rubrum*) lumber dried in the following ways: 1. Dried at 230°F green from the saw; 2. Dried by a conventional schedule to 45 percent moisture content (MC), then dried at 230°F; 3. Dried by a conventional schedule to 30 percent MC, then dried at 230°F; 4. Dried by a conventional schedule to 20 percent MC, then dried at 230°F; 5. Dried completely by a conventional schedule (control). Final target MC was 6 percent in all cases.

44. Tighten Up Your Mill with Veneer Improvement Program

Danielson, Jeanne; VonSegen, William; Donivan, Tim
Plywood & Panel World. 27(3): 18-21; 1986.

Veneer Mill Improvement Program (VIP) is a tool to help a rotary veneer mill measure its raw material conversion efficiency, identify causes of veneer loss and predict the effects of processing improvements. It was developed by the Forest Products Laboratory in conjunction with State and Private Forestry. Three areas are analyzed in a VIP study: log bucking, block centering in the lathe, and veneer peeling and clipping.

45. Producing Studs from Paper Birch by Saw-Dry-Rip

Erickson, Robert W.; Petersen, Harlan D.; Larson, Timothy D.; Maeglin, Robert
USDA Forest Serv. Res. Pap. FPL-RP-480; 1986. 8 p.

The research reported here compares the amount of warp of conventionally sawn paper birch studs with that of studs produced by the Saw-Dry-Rip (SDR) method. This research was phase 2 of a three-part study: Phase 1, investigation of the drying of nominal 2-inch paper birch flitches by various methods; phase 2, comparison of the amount of warp obtained in conventionally produced and SDR-produced studs; and phase 3, comparison of the strength of studs dried at high temperature and conventional kiln temperature. Results of phase 1 have been published as an FPL research paper and phase 3 research is currently underway.

An Evaluation of the Saw, Dry and Rip Process to Convert Red Alder into Studs

Layton, T. F.; Smith, W. R.; Maeglin, R. R.
Wood Sci. Technol. 20(2): 185-200; 1986.
(Available from W. Ramsay Smith, College of Forest Resources, AR 10, University of Washington, Seattle, WA 98195. No charge.)

The conversion of red alder (*Alnus rubra* Bong.) into structural lumber using the Saw-Dry-Rip (SDR) process was analyzed by comparing product yield and quality from conventional and SDR conversion processes and from conventional and high temperature drying schedules. A limited economic assessment was also made. It was found that conventionally processed studs had 53 percent rejects due to warp which was reduced to 6.1 percent by using the SDR process and high temperature drying. Site had a significant effect on degree of warp.

46. Increased STUD Grade Yield of Plantation Southern Pine by Saw-Dry-Rip

Maeglin, Robert R.; Boone, R. Sidney
USDA Forest Serv. Res. Pap. FPL-RP-479; 1986. 8 p.

Saw-Dry-Rip (SDR) is a simple process. Small, 8- to 12-inch logs are live sawn (through and through on the same plane) into 7/4 thick flitches, dried, and then ripped to the desired widths. In this study, SDR is compared with conventional cant sawing, the industry norm, in regard to type and amount of warp of processed studs. The capacity of SDR to process more than one species simultaneously is also discussed.

47. The Use of Saw-Dry-Rip to Produce Southern Red Oak, Sweetgum, and Blackgum Squares

Maeglin, Robert R.; Simpson, William T.; Schroeder, James G.
In: Business as usual—a sure loser! Proceedings, 14th annual hardwood symposium of the Hardwood Research Council; 1986 May 18-21; Cashiers, NC. Memphis, TN: Hardwood Research Council; 1986: 148-161.

The use of two new technologies for the manufacture of turning squares resulted in less warp in a much shorter time than current practice provides. The technologies were Saw-Dry-Rip (SDR) and vacuum-dehumidification drying. The species evaluated were southern red oak, blackgum, tupelo, and sweetgum.

48. The Effect of Wetwood on Lumber Drying Times and Rates: An Exploratory Evaluation with Longitudinal Gas Permeability

Ward, James C.
Wood Fiber Sci. 18(2): 288-307; 1986.

Lumber containing wetwood, or sinker heartwood, cannot be dried as rapidly as lumber with normal wood. To determine why wetwood dries more slowly, measurements of longitudinal gas permeability (LGP) were made in sapwood, heartwood, and wetwood from white fir (*Abies concolor*) and aspen (*Populus tremuloides* and *P. grandidentata*). The LGP values were then compared with drying times, drying rates, and anatomical characteristics of matched wood samples. Sapwood had highest average LGP values (11 to 38 Darcys) and fastest drying rates. Heartwood had lowest average LGP values (0.2 to 0.8 Darcy) and slow drying rates, but short drying times because of low green moisture content. Wetwood had longest drying times and slowest drying rates, but higher average LGP values (0.2 to 2.5 Darcys) than heartwood.

pulp, paper, and packaging

49. Adhesive's Influence on Edgewise Compression Creep in a Cyclic Relative Humidity Environment

Byrd, Von L.
Tappi J. 69(10): 98-100; 1986.

Exposure to cyclic relative humidity (RH) increases creep rate of both corrugated fiberboards and their component linerboards and corrugating mediums. Cyclic RH creep rates were measured on paperboards lap-joined with either water-sensitive or water-resistant adhesives, and the rates were compared with creep rates of short-column specimens bonded with the same adhesives. The sensitivity of adhesive to moisture adversely affects the ability of the corrugated fiberboard to resist creep deformation in a service environment. Water-resistant adhesive helps to stabilize the corrugated fiberboard structure and thus resist cyclic RH creep deformation better than corrugated fiberboard made with water-sensitive adhesive.

50. How Web and Press Parameters Interact to Control Water Removal in the Wet Press

Caulfield, D. F.; Young, T. L.; Wegner, T. H.
Tappi J. 69(6): 90-93; 1986.

The authors expand the equation for Kelvin-body dewatering response in multinip pressing, discuss the interaction of press parameters and web properties τ and C ' on web dewatering, and show an example of how the web-dewatering response equation is applied. In addition, they touch upon the concepts of press impulse and carry-through factor as they related to the equation for Kelvin-body response.

51. High-speed Press Drying: A Comparison of Three Approaches

Gunderson, Dennis; Hunt, John; Setterholm, Vance
Tappi J. 69(11): 114-117; 1986.

Press-drying concepts have been repeatedly demonstrated to be effective in laboratory and pilot-scale tests. However, significant engineering problems confront direct scale-up of the low-speed process. This study evaluates the performance of three processes that retain characteristics of press drying but bypass the most difficult engineering problems. Wet-web specimens were conditioned, densified, and dried in a specially constructed high-speed simulator apparatus. Principal variables were pressing media, restraint method, wet-web moisture content, and pressing force. Double-felted pressing of high-moisture-content webs followed by continuous taut-wire restraint yielded the best results.

52. Press Drying Recycled Multi-Ply Boxboard

Horn, Richard A.
Tappi J. 69(11): 80-84; 1986.

This study assesses the effect of press drying on wet webs of commercially formed multi-ply recycled boxboard at simulated commercial machine speeds. The webs were taken from three points along a commercial paper machine to obtain materials of varied moisture content. The webs were press dried using either a static-platen method or a semidynamic method (the FPL press-dry simulator) that operated at three levels of pressure, roll temperature, and simulated machine speed. The boxboards were evaluated for compressive strength (ring crush), tensile strength, ply-bond strength, stiffness, and smoothness. The properties of the press-dried boxboards were compared with those of the conventionally dried, calendered, commercial multi-ply recycled boxboard to determine whether there were any quality advantages associated with the press-drying process.

53. Press Drying Chemithermomechanical Pulp for Linerboard and Corrugating Medium

Horn, Richard A.; Bormett, David W.; Setterholm, Vance C.
New technologies in web consolidation and drying: Conference papers; 1986 May 19-23; Brighton, Sussex, UK. Leatherhead, Surrey, England: Pira Paper and Board Division; 1986. vol. 2. 18 p.

Chemithermomechanical pulp (CTMP) is not presently used in the manufacture of linerboard or corrugating medium. Because of its high lignin content and stiff fibers, conventional drying technology cannot achieve sufficient bonding for products requiring high strength. The aims of this study were: (1) to determine whether acceptable linerboard and corrugating medium could be made from two differing 100 percent hardwood CTMP furnishes using the press-drying process, (2) to evaluate the strength of combined boards and containers made from these hardwood CTMP press-dried components, and (3) to identify possible problems associated with converting press-dried hardwood CTMP paperboards to containers. Results showed that press-drying technology offers potential for using high-yield CTMP made from hardwoods for the manufacture of high-strength paperboard products.

54. Unitizing Goods on Pallets and Slipsheets

Laundrie, James F.
USDA Forest Serv. Gen. Tech. Rep. FPL-GTR-52; 1986. 45 p.

The purpose of this manual is to promote the most effective use of wood and wood fiber in current packaging and shipping practices by providing a basic understanding of the many factors involved in selecting an optimal method of unitizing goods on pallets and slipsheets. The manual also provides a valuable place of reference for the numerous standards and specifications relating to unitizing loads.

55. Retaining Raised Fibrils and Microfibrils on Fiber Surfaces

Sachs, Irving B.
Tappi J. 69(11): 124-127; 1986.

The author used hexamethyldisilazane (HMDS) treatment to: (a) maintain raised fibrils and microfibrils from fiber surface during drying, (b) raise fibrils and microfibrils where they have been dried down on fiber surfaces, and (c) determine if strength properties of sheets produced from HMDS-treated fibers are improved. SEM analysis showed that HMDS-treated fibers retained most fibrils and microfibrils in a raised position, while most fibrils and microfibrils from air-dried and paper-machine-dried fibers were dried down upon the fiber surfaces. Fibers that were air dried or paper machine dried, rewet, and then treated with HMDS raised many dried-down fibrils and microfibrils. The burst, tensile, and compression indices of handsheets made from HMDS-treated and never-dried pulps were greater than handsheets made from pulps dried by air or on the paper machine. This suggests that fibrils and microfibrils that remain in a raised position after drying lead to better contact between fibers.

56. Microscopic Observations During Longitudinal Compression Loading of Single Pulp Fibers

Sachs, Irving B.
Tappi J. 69(7): 98-102; 1986.

In this study, the author observed the events occurring during compression failure of a single pulp fiber by using a single-fiber compression device that was specifically designed for use in the specimen chamber of an SEM. This permits high-magnification, high-resolution examination of changes in the walls of individual pulp fibers as they undergo longitudinal compression. Loblolly pine kraft pulp fiber was subjected to longitudinal compression loading so that dislocations (slip planes), piling up of fibrils, and fractures could be observed.

Press Drying of Paper

Setterholm, V. C.
In: Bever, Michael B., ed. Encyclopedia of Materials Science and Engineering; vol. 6. Elmsford, NY: Pergamon Press Inc.; 1986: 3912-3913. (Available through libraries.)

The author discusses the background, process, benefits and future of press drying of paper. Ongoing research of the press-dry concept is also mentioned.

57. Bleaching Groundwood and Kraft Pulps with Potassium Peroxymonosulfate—Comparison with Hydrogen Peroxide

Springer, Edward L.; McSweeny, James D.
TAPPI Proceedings: 1986 Pulping Conference; 1986 October 26-30; Toronto, ON. Atlanta, GA: TAPPI Press; 1986: 671-681. Book 3.

Hardwood and softwood groundwood, kraft and delignified kraft pulps were bleached, under optimum conditions, with alkaline solutions of potassium peroxymonosulfate. For purposes of comparison, the same pulps were bleached, under optimum conditions, with equivalent amounts (active oxygen basis) of alkaline hydrogen peroxide.

58. Dehydration Conditions can Improve Formaldehyde Crosslinking of Linerboard

Young, T. L.; Caulfield, D. F.
Tappi J. 69(9): 124-128; 1986.

Restricting moisture penetration into the fiber cell walls of linerboard by crosslinking can preserve its dry-state structural integrity. Using formaldehyde and sulfur dioxide to form acetal bond crosslinks requires shrinking of the fibers in a dehydrating environment. The rate and extent to which reactants are lost from the linerboard at a given temperature depends upon dehydration conditions. Through proper selection of process variables, the degree of linerboard dehydration with shrinkage can be controlled to approach optimum values of effectively bound formaldehyde and linerboard pH.

59. Effect of Process Variables on Formaldehyde Crosslinking of Corrugated Fiberboard

Young, Teresa L.; Caulfield, Daniel F.
Tappi J. 69(2): 90-95; 1986.

In this study, the authors used a Box-Wilson-type experimental design with regression analysis to study the effect of process variables on crosslinking in single-wall corrugated fiberboard. They determined the effects of three process variables—formaldehyde level, the molar ratio of sulfur dioxide to formaldehyde, and reaction temperature—on four response functions that indicated the extent of reaction: y_1, wet to dry stiffness ratio; y_2, extent of crosslinking achieved; y_3, percent residual, free formaldehyde after reaction; and y_4, pH of the fiberboard components after reaction.

structural fiber and particle products

60. Wood Particleboard and Flakeboard: Types, Grades, and Uses

Carll, Charles
USDA Forest Serv. Gen. Tech. Rep. FPL-GTR-53; 1986. 9 p.

This report is for those who use or may want to use wood particleboard (including flakeboard). Types and grades of particleboard are described and discussed in relation to end uses as nonstructural underlayment, stair tread, shelving, furniture, core material, cabinetry, structural sheathing, subflooring and combination subfloor/underlayment, and siding.

61. Electron Microscopy Study of Hardboards

Murmanis, Lidija; Youngquist, John A.; Myers, Gary C.
Wood Fiber Sci. 18(3): 369-375; 1986.

Wet-formed and dry-formed aspen fiber hardboards are examined by transmission electron microscopy to obtain information on the hardboard internal structure and fiber-resin interactions. These factors, when related to strength and dimensional properties of hardboards, may be helpful in determining hardboard quality and suitability for structural use.

62. A Comparison of Hardboards Manufactured by Semidry-, Dry-, and Wet-Formed Processes

Myers, Gary C.
Forest Prod. J. 36(7/8): 49-56; 1986.

The semidry-formed process was investigated as a possible alternative to the wet- and dry-forming processes of manufacturing hardboards. The objective was to improve performance and/or reduce the amount of resin required. A single wood species, aspen, was fiberized in a small pressurized refiner and used for all hardboard manufacturing trials. In addition to producing water-felted fiber mats, other mats were air felted at 65, 35, and 5 percent moisture content.

63. Vapor Phase Acetylation of Southern Pine, Douglas-Fir, and Aspen Wood Flakes

Rowell, Roger M.; Tillman, Anne-Marie; Simonson, Rune
J. Wood Chem. Technol. 6(2): 293-309; 1986.

Southern pine, Douglas-fir, and aspen wood flakes were acetylated with acetic anhydride vapor and compared with flakes acetylated with liquid acetic anhydride diluted with xylene. The rate of acetylation was much lower for the vapor than for the liquid phase reaction. Acetylation weight percent gains above 20 were achieved by both methods.

64. A Simplified Procedure for the Acetylation of Hardwood and Softwood Flakes for Flakeboard Production

Rowell, Roger M.; Tillman, Anne-Marie; Simonson, Rune
J. Wood Chem. Technol. 6(3): 427-448; 1986.

Southern pine and aspen flakes were acetylated with acetic anhydride alone without cosolvent or catalyst by a simple dip procedure. The new procedure greatly shortens reaction time and simplifies chemical recovery. Flakeboards made from acetylated southern pine or aspen flakes absorbed much less water, both in water-soaking tests and when subjected to humid air, and swelled at a lower rate and to a lower extent than did control boards. Hygroscopicity of the resulting flakeboards decreased with increased level of wood acetylation.

65. Flakeboards Made from Aspen and Southern Pine Wood Flakes Reacted with Gaseous Ketene

Rowell, Roger M.; Wang, Richard H.S.; Hyatt, John A.
J. Wood Chem. Technol. 6(3): 449-471; 1986.

Southern pine and aspen wood flakes were chemically modified by reaction at *ca.* 55°C with ketene in the absence of solvent. Reactions were relatively slow, with weight gains of up to 17 and 20 percent, respectively, obtained. Acetyl content correlated with weight gain only up to the 12 percent level. Water and solvent extraction of ketene-modified southern pine and aspen flakes showed very little loss in acetyl.

timber requirements and economics

Analyzing Structure in Wood-Based Industry: Part I. Identifying Competitive Strategy

Cleaves, David A.; O'Laughlin, Jay
Forest Prod. J. 36(4): 9-14; 1986. (Available from Forest Products Research Society, 2801 Marshall Court, Madison, WI 53705; $2 each, with $5 minimum, plus 10% postage and handling.)

This paper describes several functions that help determine business-level strategy in a wood-based industry: manufacturing, diversification and integration, geographic specialization, marketing and distribution, procurement, and timberland ownership. It also discusses how each of these functions contributes to the competitive position of a firm.

Analyzing Structure in Wood-Based Industry: Part II. Categorizing Strategic Diversity

Cleaves, David A.; O'Laughlin, Jay
Forest Prod. J. 36(5): 11-17; 1986. (Available from Forest Products Research Society, 2801 Marshall Court, Madison, WI 53705; $2 each, with $5 minimum, plus 10% postage and handling.)

This paper reports the authors' study of firms in the southern plywood industry to show how they vary across functions and to identify those with similar strategies. Grouping firms with similar strategies might provide more convenient units of analysis for future studies of industry structure, performance, and conduct.

Impacts of Forest Utilization Research: An Economic Assessment

Gregersen, H.; Haygreen, J.
University of Minnesota, College of Forestry, Department of Forest Resources, St . Paul, MN 55108 [1985]. (Available from National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161; $16.95; PB86-226248/AS.)

The economic impacts of certain major wood utilization technologies derived in part or in total from U.S. Forest Service research are evaluated. Specifically, the analysis focuses on reductions in softwood timber consumption because of improved softwood utilization and substitution of hardwoods for softwoods, both of which ease the pressure on softwoods for any given output level of processed products.

66. Economics of Fiber Cost and Compressive Strength of Single-Wall Corrugated Boxes

Ince, Peter J.; Urbanik, Thomas J.
Tappi J. 69(10): 102-105; 1986.

Research has shown how to estimate box performance in terms of compressive strength for combinations of linerboard and corrugating medium components. One study illustrated how similar concepts provide a means to calculate minimum cost designs for corrugated containers. Here, the authors extend the previous studies and describe an economic theory of optimum fiber distribution in single-wall corrugated boxes. The authors show how the optimal mix changes as relative market values change for linerboard and corrugating medium, and offer a graphic and analytic interpretation of the theory.

67. Wood Used in Pallets Manufactured in the United States, 1982

McKeever, David B.; McCurdy, Dwight R.; Kung, Fan Hao; Ewers, James T.
USDA Forest Serv. Resour. Bull. FPL-RB-17; 1986. 13 p.

This paper reports results of a cooperative study by the USDA Forest Service, Southern Illinois University at Carbondale, and Tuskegee Institute. The study was designed to provide statistically reliable information on national and regional use of wood in pallets, by species and pallet type. An estimated 17 fbm of wood were required to produce a finished pallet; the finished pallet contained 12.7 fbm of wood. This is less wood per pallet than had previously been thought.

Appendix F. Supplementary Analysis: An Evaluation of the Stumpage Market Impact of Timber Utilization Research Using the Timber Assessment Market Model (TAMM)

Skog, Kenneth E.; Haynes, Richard W.
In: Impacts of forest utilization research: An economic assessment. St. Paul, MN : University of Minnesota, College of Forestry, Department of Forest Resources, St. Paul, MN 55108 [1985]. 19 p. (Entire report available from National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161; $16.95; PB86-226248/AS.)

The purpose of this appendix is, first, to analyze how adoption of innovations identified in the main body of this report will affect projected timber consumption and prices; and second, to estimate how innovation-induced consumption and price changes will translate into reduced value (savings) of softwood timber harvested, and increased value (extra cost) of hardwood timber harvested through the year 2000. In the main body of this report, the authors estimated net timber stumpage value saved as a result of adopting wood utilization innovations.

Future Inventories for Multiresource Forest Management

Stone, Robert N.; Ek, Alan R.
In: LaBau, Vernon J.; Kerr, Calvin L., eds. Inventorying Forest and Other Vegetation of the High Latitude and High Altitude Regions: Proceedings, Society of American Foresters Regional Technical Conference; 1984 July 23-26; Fairbanks, AK. Bethesda, MD: Society of American Foresters; 1984: 265-269. (Complete proceedings available from John Schmidt, Society of American Foresters, 5400 Grosvenor Lane, Bethesda, MD 20814; $20.)

Future inventories of forest and wild land resources will be required to provide new and better information for tomorrow's policy and management questions. Characteristics of the "ideal" inventory for policy and planning concerns, onsite management needs, and environmental interests are addressed in the setting of our area of the future. Items discussed are expected use of information, cost/value of the information, statistical reliability, time frame (frequency), surveys for policy versus surveys for onsite management, and possible technical advances that will change current concepts of forest surveys.

tropical wood utilization

Timbers of Central and South America

Miller, R. B.
In: Bever, Michael B., ed. Encyclopedia of Materials Science and Engineering; vol. 8. Elmsford, NY: Pergamon Press, Inc.; 1986: 5025-5031. (Available through libraries.)

The author discusses the timbers of Central and South America and summarizes the properties and uses of these woods.

wood bonding systems

68. Potential of Carbohydrates for Exterior-Type Adhesives

Christiansen, A. W.; Gillespie, R. H.
Forest Prod. J. 36(7/8): 20-28; 1986.

Adhesives presently used for exterior-type, wood-based products depend upon petroleum for their starting materials. With the increasing energy needs of an expanding population and the inevitable decline in oil and gas supplies in the long term, the need for alternative adhesive systems from renewable resources is self-evident. The purpose of this investigation was to explore the potential of carbohydrates as constituents in water-resistant adhesives.

Mechanisms of Formaldehyde Release from Bonded Wood Products

Myers, George E.
In: Meyer, B.; Andrews, B. A. Kottes; Reinhardt, R. M., eds. Formaldehyde Release from Wood Products: ACS symposium series 316; 1985 April 28-May 3; Miami Beach, FL. Washington, DC: American Chemical Society; 1986: 87-106. (Entire book available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036; $49.95.)

The overall objective of this paper is to define the extent to which board formaldehyde emission is controlled by resin hydrolysis or other processes.

69. Effects of Post-Manufacture Board Treatments on Formaldehyde Emission: A Literature Review (1960-1984)

Myers, George E.
Forest Prod. J. 36(6): 41-51; 1986.

This paper reviews the literature dealing with the many post-manufacture board treatments used to reduce formaldehyde emission from urea-formaldehyde bonded boards. Such treatments have almost solely used one or more of five chemical or physical principles: 1) formaldehyde reaction with NH_3, 2) formaldehyde reaction with oxygenated sulfur compounds, 3) formaldehyde reaction with organic-NH functionality, 4) pH adjustment, and 5) physical barrier.

70. Kinetic Behavior of Formaldehyde Crosslinking of Linerboard

Young, Teresa L.
Cellulose Chem. Technol. 20: 117-132; 1986.

The author examines the kinetic behavior of the formaldehyde crosslinking reaction on a southern pine kraft linerboard. Determined are effects of initial formaldehyde level and associated swelling of the linerboard on (1) formaldehyde binding rates, (2) the extent of crosslinking, and (3) the reaction rates, orders, and corresponding rate constants. Also shown is a way to express the overall reaction rate constants in terms of resistance to reaction as measured by the effective specific surface area ratios of the swollen linerboards.

special item

The following item was published in 1984, but quickly sold out. The U.S. Government Printing Office has now reprinted it and is again offering it for sale.

Tropical Timbers of the World

Chudnoff, Martin
USDA Forest Serv. Agric. Handb. 607, Washington, DC; 1984. 466 p. (Available from Superintendent of Documents, U.S. Government Printing Office, 710 North Capitol Street, Washington, DC 20402; $16.00; 001-001-00609-2.)

The publication provides university, industrial, and other research facilities—as well as processors of tropical woods and importers—with an invaluable reference book that is well organized and easy to use.

Information on the 370 species includes scientific and common names, distribution, general characteristics, weight, mechanical properties, and a listing of current uses. In addition to the individual species entries, there is a section containing comparative tables of specific properties and end uses. Following these tables is an index of trade names and important common names, geographic regions, and scientific names.

Planalto forest south of Santarem in the Rio Curua-Una region, Brazil. About 60 percent of the volume is in species considerably denser than U.S. commercial woods (basic specific gravity over 0.70).

Over the past two decades U.S. lumber imports from the tropics have increased fourfold. Plywood trade, mostly from Asian sources, has soared fortyfold and now equals our domestic production. Log imports, though, have decreased drastically from about 100 million board feet (log scale) in the 1950's to 30 million currently. Much of the world timber trade now is in the form of processed material. A wide array of tropical wood species and species groupings are now available to U.S. processors. Many are already well known on the European markets. This surge in supplies from overseas includes softwoods, hardwoods, decorative species, and utility woods.

U.S. GOVERNMENT PRINTING OFFICE:1987-742-044/40014

Selected Publications from the U.S. Government Printing Office

The following publications written by scientists at the Forest Products Laboratory are available for sale through the Superintendent of Documents, U.S. Government Printing Office:

Air Drying of Lumber: A Guide to Industry Practices

Rietz, Raymond C.; Page, Rufus H.
Agriculture Handbook 402, 110 p.
U.S. Department of Agriculture
Stock number 001-000-04332-3, $4.75

This handbook describes how lumber can be dried most effectively under outdoor conditions and illustrates air drying principles and procedures developed through field investigations and observations of industrial practices. Particular emphasis is placed on the yarding of lumber in unit packages.

A Collection of Log Rules

Freese, Frank
General Technical Report FPL 1 [1973], 65 p.
U.S. Department of Agriculture
Forest Service, Forest Products Laboratory
Stock number 001-001-00367-1, $5.00

This report lists and describes log rules obtained from more than 200 references listed in the appendix. These formulas, showing the estimated net yield (board feet or cubic volume) for logs of a given diameter and length, are compiled to document this important element in the history of forestry and the lumbering industry.

Dry Kiln Operator's Manual

Rasmussen, Edmund F.
Agriculture Handbook 188 (1961, reprinted 1980), 197 p.
U.S. Department of Agriculture
Stock number 001-000-00690-8, $7.00

This handbook presents knowledge of kiln-drying principles useful to owners and operators of dry kilns. The techniques can be applied in the drying of lumber, dimension stock, cooperage stock, and many special items such as gunstock, bowling pin, and shoe last blanks. The manual is also a text on the theory and practice of kiln-drying.

Drying Eastern Hardwood Lumber

McMillen, John M.; Wengert, Eugene M.
Agriculture Handbook 528, (1978, reprinted 1985), 104 p.
U.S. Department of Agriculture
Stock number 001-000-03761-7, $5.50

This handbook presents recommendations based on recent research and industry practice for drying eastern hardwood lumber, including dimension items. Accent is on comparing methods for energy-saving management decisions, but practical guidance is also given to wood drying personnel. Air drying, accelerated air drying, and kiln drying are covered.

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